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righteousness—behind all seeming moral disorder and evil. I repeat, then, that whatever is a necessary condition of our highest activity—whatever is contributive to the best interests of our *whole* humanity and in the *final outcome*—must be in some sense true. I am quite aware that we are often mistaken as to what ideas come under this head, but we are mistaken only through a too limited and personal view.

Therefore, in a true philosophy, we cannot wholly leave out consequences. It would be irrational to do so. "But observe; I speak of consequences only as a *test* of truth. I would not swerve a hair's breadth in absolute devotion to truth. Whatever is really true will surely vindicate itself as such by its beneficence, if we only wait patiently for final results."*

So much for the principle criticised. Nevertheless, I freely admit that I may be wrong in thinking that these dire consequences would follow if natural selection be the only factor in social evolution. There may be, and indeed I am sure there is, a natural selection of fittest ideas and institutions, and thereby a gradual improvement of the social environment, which must be a powerful factor of progress, and of which I did not take sufficient account.† But to show that I have not been wholly unmindful of this factor I quote from a recent paper:‡ "Ideas are like species. In the evolution of thought, some indeed become extinct and have no progeny, but some are transformed into new, and all the new come only by such transformation of the old."

JOSEPH LE CONTE.

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THE KATYDID'S ORCHESTRA.

TO THE EDITOR OF SCIENCE: Possibly the phenomenon I am about to describe is well known to biologists, but to me it is unknown, and it seems so remarkable that it is worth recording. It is the only instance I know of in nature of any continued attempt at concerted harmony and measured time-keeping on the part of many animals. With all the musical or sound-mak-

ing capacities of animals none seems to have much of an idea of measured time-beating, and in no instance known to me is there any attempt of large numbers to unite the individual notes into a common musical result. The universal fact of preserved individualism, and indifference to unisonal effect, is a noteworthy one when we consider the high degree of musical sense with which some animals are endowed.

Probably every person would express disgust at the idea of the stridulous noise of the Katydid being musical, and surprise at the suggestion that there is any rhythm or unison in many of them, but for weeks the fact has been all too apparent to my family for the purposes of sleep. Our house has been upon a mountain top in North Carolina, surrounded by a grove of trees, and farther away by woods upon all sides. So soon as the sun has set and twilight is advancing, the katydids in the trees begin to 'tune up.' The first notes are scattered, awkward, and without rhythm, but if no wind is blowing, thousands soon join in and from that time until daylight breaks there is no intermission. It is marvellous that the organs can withstand this continual rubbing for eight hours. By choosing out an insect close by and listening to it alone I have convinced myself that the same insect keeps at it at least for hours at a time. These raspings are seldom three at a time, as the popular name would imply, but are the result of usually four or five, sometimes six, distinct but closely joined movements. When united with a thousand others the disjunction of these tones is, of course, not perceptible, and they sound like a single note. In order to make my description clearer, let us suppose one thousand Katydids scattered through the trees to utter their several notes all at once, and call them Company A. Another thousand, Company B., at once answers them, and this swing-swing is kept up, as I say, all night. Company A's note is the emphatic or accented note, and is more definitely and accurately a precise musical note, whilst the note of Company B varies from one to five half tones below, the most conspicuous note being five. In the old-fashioned musical terms I learned as a boy, Company B's note is *e. g.*, clearly and definitely *do*, while the note of Company B is either *la*, or more cer-

* 'Evolution and its relation to religious thought,' p. 279.

† Geol. Dep't, University of California, Bull. No. 11, p. 336.

tainly *sol*, below. Not only is Company A's note more unisonal and definite, but it is firmer, more accented, and it seems to me that more insects join in this note than in the second. Careful observation has convinced me that no insect of Company A or Company B ever joins in the other company's note. The rhythm is usually perfect unless there is a disturbance by a breeze. A sharp gust upsets the whole orchestra and confusion results, but the measured beat is soon refound. In the instants of confusion one can detect the steady see-saw of certain ones, as it were, 'leaders,' or 'first violinists,' who hold the time-measure despite the wind, and who soon draw the lost notes of the others once more into the regular measure or beat. I do not mean to say that by diligent attention one may not at times detect individuals sawing out of time, stray fellows that are indifferent or careless, but the vast majority usually even seemingly without a single exception, if there is no wind or rain, thus swing along hour after hour in perfect time. I have counted the beats several times and find the number is always identical, 34 double beats or 68 single ones in 60 seconds. The effect of the rhythm upon the mind is not unlike that of the woodsman's cross-cut saw handled by two steady, tireless pairs of hands, although the *Katyids* give a larger volume of sound and the *timbre* is harsher. The queries arise: Is Company A composed of males and Company B of females? What function does the orchestration subserve? Is there anything comparable to it among other animals?

Sincerely yours,

GEORGE M. GOULD.

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SCIENTIFIC LITERATURE.

A Text-Book of Physiology by M. FOSTER, M. A., M. D., LL. D., F. R. S. Professor of Physiology in the University of Cambridge and Fellow of Trinity College, Cambridge. Revised and abridged from the author's text-book of physiology in five volumes. New York, Macmillan & Co. 1895.

We remember the third edition of Dr. Foster's celebrated text-book with gratitude and affection. It was different from other books then in common use. This book had style to begin

with; and style is a rare quality in such writings. It had an air of being at the center of things. There was a certain glow of enthusiasm in its pages, breaking through at times what seemed the habitual restraint of a scholar who was also a man of the world. Such moments were very welcome. Not less welcome were the brief accounts of celebrated controversies. How we venerated the name of Ludwig! What high resolves were stirred by the triumphs of Bernard, Heidenhain, Marey and Du Bois-Reymond! How amazingly clever were Goltz and Gaule to have thought of measuring the pressure in the heart with a minimum valve! These were not merely the easily excited reactions of impressionable youth. Fourteen years have passed since those delightful days and have but strengthened our belief that this was a most stimulating and helpful book.

The first, second and third editions were much alike. They set forth 'that which is fixed and sure, without too much display or too much neglect of that which is uncertain and loose.' They introduced in smaller type discussions on debated points. The fourth edition and its successors differ from the earlier volumes. The discussions on debated points are either left out or much abridged or are transformed by the omission of the references to original sources. In the preface to the fourth edition Dr. Foster explained that his decision to do away with the small print portions of former editions had been largely determined by the fact that this former pupils, now his colleagues at Cambridge, had undertaken to join with him in treating these higher or advanced parts of physiology in a more extended and satisfactory form. The hope that the result of their labors would soon appear led him to omit all references and to use as little as possible the personal authority of the names of investigators. "The fondness of students for the use of names of persons is as marked as the pertinacity with which they use them wrongly."

The hope which the author here expressed is fulfilled in the fifth edition, in which Dr. Gaskell, Mr. Langley and Dr. Lea have given great assistance. The result is a work of about two thousand pages in five volumes. Part I. treats of the blood, the contractile tissues and the vas-